

## PALM INTRANET

Day : Thursday  
Date: 10/31/2002

Time: 13:25:01

## Inventor Name Search Result

Your Search was:

Last Name = JACQ

First Name = GERARD

Application#	Patent#	Status	Date Filed	Title	Inventor Name
09367881	6228152	150	08/18/1999	FILTERING DEVICE FOR EQUIPPING A VENTILATION AND/OR HEATING AND/OR AIR CONDITIONING UNIT, MORE PARTICULARLY FOR A MOTOR VEHICLE	JACQ , GERARD
08553573	5807518	150	11/27/1995	FRICTION MATERIAL DESIGNED FOR FITTING TO A DEVICE EMPLOYING FRICTION IN A LIQUID MEDIUM, AND THE METHOD OF PRODUCING SUCH A FRICTION MATERIAL AND THE DEVICE TO WHICH IT IS FITTED	JACQ , GERARD
09041538 <i>me</i>	Not Issued	071	03/11/1998	FRICTION MATERIAL DESIGNED FOR FITTING TO A DEVICE EMPLOYING FRICTION IN A LIQUID MEDIUM, AND A METHOD OF PRODUCING SUCH A FRICTION MATERIAL AND THE DEVICE TO WHICH IT IS FITTED	JACQ , GERARD
08668264	Not Issued	124	06/20/1996	FRICTION MATERIAL FOR A DRY FRICTION DEVICE, A METHOD OF MAKING SUCH A DRY FRICTION MATERIAL, AND A DRY FRICTION DEVICE EQUIPPED WITH SUCH A MATERIAL	JACQ , GERARD
09329595	6200368	150	06/10/1999	COMBINED FILTER DEVICE FOR FILTERING OUT PARTICLES AND GASES	JACQ , GERARD
08074229	Not	161	06/09/1993	PROCESS FOR CONVERTING	JACQUET ,

	Issued			STRUCTURED DOCUMENTS FROM ODA/ODIF FORMAT TO RTF FORMAT	GERARD
<u>08973411</u>	Not Issued	169	07/07/1997	SYSTEM FOR DETECTING WATER LEAKS AND PREVENTING WATER DAMAGE	JACQUET , GERARD

**Inventor Search Completed: No Records to Display.**

	<b>Last Name</b>	<b>First Name</b>	
<b>Search Another: Inventor</b>	<input type="text" value="JACQ"/>	<input type="text" value="GERARD"/>	<input type="button" value="Search"/>

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## PALM INTRANET

Day : Thursday  
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Time: 13:22:48

## Inventor Name Search Result

Your Search was:

Last Name = MENARD

First Name = DENIS

Application#	Patent#	Status	Date Filed	Title	Inventor Name
<u>09415982</u> gt	6213273	150	10/12/1999	FRICTION LINER HAVING A NETWORK OF GROOVES ,FOR A CLUTCH	MENARD , DENIS
<u>06890643</u>	4733635	150	07/30/1986	HEAT GENERATOR FOR AUTOMOBILE VEHICLES	MENARD , DENIS
<u>08553573</u> gt	5807518	150	11/27/1995	FRICTION MATERIAL DESIGNED FOR FITTING TO A DEVICE EMPLOYING FRICTION IN A LIQUID MEDIUM, AND THE METHOD OF PRODUCING SUCH A FRICTION MATERIAL AND THE DEVICE TO WHICH IT IS FITTED	MENARD , DENIS
<u>09035229</u>	6135258	150	03/05/1998	FRICTION LINER WITH CONTROLLED POROSITY, FOR A FRICTION DEVICE WORKING IN LIQUID	MENARD , DENIS
<u>08896214</u>	6035992	150	07/17/1997	FRICTION LINER HAVING A NETWORK OF GROOVES, FOR A CLUTCH	MENARD , DENIS
<u>09041538</u>	Not Issued	071	03/11/1998	FRICTION MATERIAL DESIGNED FOR FITTING TO A DEVICE EMPLOYING FRICTION IN A LIQUID MEDIUM, AND A METHOD OF PRODUCING SUCH A FRICTION MATERIAL AND THE DEVICE TO WHICH IT IS FITTED	MENARD , DENIS
<u>08765289</u>	Not Issued	161	01/13/1997	HYDROKINETIC COUPLING APPARATUS, ESPECIALLY FOR MOTOR VEHICLES, SUCH AS IS DESCRIBED IN	MENARD , DENIS

				THE DOCUMENTS WO-A-94/07058 AND WO-A-93/13339.	
<u>09785644</u>	<u>6290046</u>	150	02/16/2001	FRICTION LINER HAVING A NETWORK OF GROOVES, FOR A CLUTCH	MENARD, DENIS

Inventor Search Completed: No Records to Display.

**Search Another: Inventor**

Last Name	First Name	
<input type="text" value="MENARD"/>	<input type="text" value="DENIS"/>	<input type="button" value="Search"/>

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L Number	Hits	Search Text	DB	Time stamp
1	6416	((442/59,60,63,101,148,152,158,162,163,156,164,167,168,175,176,180,295,374,375,376,380,388,391,392) or (428/66.2,67,74,141,143,144,147,397.4,301.4)).CCLS.	US-PGPUB; EPO; JPO; DERWENT USPAT;	2002/10/31 13:01
2	969	friction\$4 and (((442/59,60,63,101,148,152,158,162,163,156,164,167,168,175,176,180,295,374,375,376,380,388,391,392) or (428/66.2,67,74,141,143,144,147,397.4,301.4)).CCLS.)	US-PGPUB; EPO; JPO; DERWENT USPAT;	2002/10/31 13:03
3	280726	fiber same (glass or wool or cotton or ceramic or polyacrylonitrile or aramid)	US-PGPUB; EPO; JPO; DERWENT USPAT;	2002/10/31 13:05
4	44348	((filler) near5 ((copper) or (rockwool) or (carbon) or (graphite) or (coke) or (zirconium) or (silicate) or (iron adj sulphide) or (alumina) or (rubber) or (diatoms)))	US-PGPUB; EPO; JPO; DERWENT USPAT;	2002/10/31 13:05
5	97366	((powder) near5 ((copper) or (rockwool) or (carbon) or (graphite) or (coke) or (zirconium) or (silicate) or (iron adj sulphide) or (alumina) or (rubber) or (diatoms)))	US-PGPUB; EPO; JPO; DERWENT USPAT;	2002/10/31 13:07
6	2236	((pulp) near5 ((glass) or (aramid) or (acrylic) or (phenolic)))	US-PGPUB; EPO; JPO; DERWENT USPAT;	2002/10/31 13:10
7	435529	(thermoset\$5) near5 (resol) or (novolak) or (aminoaldehyde) or (urea adj formaldehyde) or (melamine adj formaldehyde) or (epoxy) or (polyimide)	US-PGPUB; EPO; JPO; DERWENT USPAT;	2002/10/31 13:11
8	150	(fiber same (glass or wool or cotton or ceramic or polyacrylonitrile or aramid)) and ((thermoset\$5) near5 (resol) or (novolak) or (aminoaldehyde) or (urea adj formaldehyde) or (melamine adj formaldehyde) or (epoxy) or (polyimide)) and (friction\$4 and	US-PGPUB; EPO; JPO; DERWENT USPAT;	2002/10/31 13:11
9	36	((442/59,60,63,101,148,152,158,162,163,156,164,167,168,175,176,180,295,374,375,376,380,388,391,392) or (428/66.2,67,74,141,143,144,147,397.4,301.4)).CCLS.) and ((filler) near5 ((copper) or (rockwool) or (carbon) or (graphite) or (coke) or (zirconium) or (silicate) or (iron adj sulphide) or (alumina) or (rubber) or (diatoms)))	US-PGPUB; EPO; JPO; DERWENT USPAT;	2002/10/31 13:11
10	97394	and ((filler) near5 ((copper) or (rockwool) or (carbon) or (graphite) or (coke) or (zirconium) or (silicate) or (iron adj sulphide) or (alumina) or (rubber) or (diatoms))) and ((powder) near5 ((copper) or (rockwool) or (carbon) or (graphite) or (coke) or (zirconium) or (silicate) or (iron adj sulphide) or (alumina) or (rubber) or (diatoms)))	US-PGPUB; EPO; JPO; DERWENT USPAT;	2002/10/31 13:13
11	52	((442/59,60,63,101,148,152,158,162,163,156,164,167,168,175,176,180,295,374,375,376,380,388,391,392) or (428/66.2,67,74,141,143,144,147,397.4,301.4)).CCLS.) and (((filler) near5 ((copper) or (rockwool) or (carbon) or (graphite) or (coke) or (zirconium) or (silicate) or (iron adj sulphide) or (alumina) or (rubber) or (diatoms)))) or (((powder) near5 ((copper) or (rockwool) or (carbon) or (graphite) or (coke) or (zirconium) or (silicate) or (iron adj sulphide) or (alumina) or (rubber) or (diatoms))))	US-PGPUB; EPO; JPO; DERWENT USPAT;	2002/10/31 13:13

Search History 10/31/02 10:32:03 PM (all pages)

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12	15	((fiber same (glass or wool or cotton or ceramic or polyacrylonitrile or aramid)) and ((thermoset\$5) near5 (resol) or (novolak) or (aminoaldehyde) or (urea adj formaldehyde) or (melamine adj formaldehyde) or (epoxy) or (polyimide)) and (friction\$4 and	USPAT; US-PGPUB; EPO; JPO; DERWENT	2002/10/31 13:12
13	40	((442/59,60,63,101,148,152,158,162,163,156,164,167,168,175,176,180,295,374,375,376,380,388,391,392) or (428/66.2,67,74,141,143,144,147,397.4,301.4)).CCLS.))) or ((pulp) near5 ((glass) or (aramid) or (acrylic) or (phenolic))) or ((pulp) near5 ((glass) or (aramid) or (acrylic) or (phenolic))) or (aminoaldehyde) or (urea adj formaldehyde) or (melamine adj formaldehyde) or (epoxy) or (polyimide)) and (friction\$4 and	USPAT; US-PGPUB; EPO; JPO; DERWENT	2002/10/31 13:16
14	32	((442/59,60,63,101,148,152,158,162,163,156,164,167,168,175,176,180,295,374,375,376,380,388,391,392) or (428/66.2,67,74,141,143,144,147,397.4,301.4)).CCLS.))) and (((filler) near5 ((copper) or (rockwool) or (carbon) or (graphite) or (coke) or (zirconium) or (silicate) or (iron adj sulphide) or (alumina) or (rubber) or (diatoms)))) or (((powder) near5 ((copper) or (rockwool) or (carbon) or (graphite) or (coke) or (zirconium) or (silicate) or (iron adj sulphide) or (alumina) or (rubber) or (diatoms)))))) not	USPAT; US-PGPUB; EPO; JPO; DERWENT	2002/10/31 13:17
-	17	((27339760,63,627,388,152,158,163,076,156,164,167,168,175,176,180,295,374,375,376,380,388,391,392) or (428/66.2,67,74,141,143,144,147,397.4,301.4)).CCLS.))) and (((pulp) near5 ((glass) or (aramid) or (acrylic) or (phenolic))))	US-PGPUB; EPO; JPO; DERWENT	

## PALM INTRANET

Day : Thursday  
Date: 10/31/2002

Time: 13:31:16

## Inventor Name Search Result

Your Search was:

Last Name = GUERIN

First Name = RICHARD

Application#	Patent#	Status	Date Filed	Title	Inventor Name
<u>09367881</u>	<u>6228152</u>	150	08/18/1999	FILTERING DEVICE FOR EQUIPPING A VENTILATION AND/OR HEATING AND/OR AIR CONDITIONING UNIT, MORE PARTICULARLY FOR A MOTOR VEHICLE	GUERIN , RICHARD
<u>08553573</u> <i>check this</i>	<u>5807518</u>	150	11/27/1995	FRICTION MATERIAL DESIGNED FOR FITTING TO A DEVICE EMPLOYING FRICTION IN A LIQUID MEDIUM, AND THE METHOD OF PRODUCING SUCH A FRICTION MATERIAL AND THE DEVICE TO WHICH IT IS FITTED	GUERIN , RICHARD
<u>09041538</u> <i>me</i>	Not Issued	071	03/11/1998	FRICTION MATERIAL DESIGNED FOR FITTING TO A DEVICE EMPLOYING FRICTION IN A LIQUID MEDIUM, AND A METHOD OF PRODUCING SUCH A FRICTION MATERIAL AND THE DEVICE TO WHICH IT IS FITTED	GUERIN , RICHARD
<u>08668264</u> <i>order this</i>	Not Issued	124	06/20/1996	FRICTION MATERIAL FOR A DRY FRICTION DEVICE, A METHOD OF MAKING SUCH A DRY FRICTION MATERIAL, AND A DRY FRICTION DEVICE EQUIPPED WITH SUCH A MATERIAL	GUERIN , RICHARD
<u>09035228</u> <i>check this</i>	<u>6056100</u>	150	03/05/1998	FRICTION LINER FOR A DRY FRICTION DEVICE, A METHOD OF MAKING SUCH A LINER, AND A CLUTCH	GUERIN , RICHARD

				FRICITION WHEEL HAVING SUCH A LINER	
<u>09329595</u>	<u>6200368</u>	150	06/10/1999	COMBINED FILTER DEVICE FOR FILTERING OUT PARTICLES AND GASES	GUERIN , RICHARD
<u>60231097</u>	Not Issued	020	09/08/2000	METHOD FOR PROCESSING MEDICAL PRESCRIPTIONS	GUERIN, RICHARD
<u>09926490</u>	Not Issued	030	12/17/2001	ENCAPSULATED METAL NODULES FOR THE FORMATION OF SACRIFICIAL ANODES IN MORTAR OR REINFORCED CONCRETE AND METHOD FOR THE PRODUCTION OF SAID NODULES	GUERIN, RICHARD
<u>09438597</u> <i>get HWS</i>	Not Issued	120	11/12/1999	FRICITION LINER FOR A DRY FRICITION DEVICE, A METHOD OF MAKING SUCH A LINER , AND A CLUTCH FRICITION WHEEL HAVING SUCH A LINER	GUERIN, RICHARD
<u>10017875</u>	Not Issued	030	12/12/2001	COMMAND ORDERING	GUERIN, RICHARD

Inventor Search Completed: No Records to Display.

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<input type="text" value="GUERIN"/>	<input type="text" value="RICHARD"/>

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**PATENT APPLICATION FULL TEXT AND IMAGE DATABASE**

( 1 of 1 )

**United States Patent Application****20010004573****Kind Code****A1****MENARD, DENIS ; et al.****June 21, 2001**

FRICITION MATERIAL DESIGNED FOR FITTING TO A DEVICE EMPLOYING  
FRICITION IN A LIQUID MEDIUM, AND A METHOD OF PRODUCING SUCH A  
FRICITION MATERIAL AND THE DEVICE TO WHICH IT IS FITTED

**Abstract**

A friction material for a liquid medium, according to the invention, consists of a fibre mat impregnated with a thermosetting resin, the fibres having a length of at least 12 mm. The method of producing such a material includes the following steps: a) a mixture of fibres of the same nature or of different natures is produced in a mixer; b) the mixture is carded to form a card web; c) the card web is lapped; d) the lap thus formed is needled; e) the needled mat is impregnated with a thermosetting resin.

**Inventors:** **MENARD, DENIS;** (*LIMOGES, FR*) ; **GUERIN, RICHARD;** (*FLERS, FR*) ;  
**BOUTAUD, JEAN-PIERRE;** (*PANAZOL, FR*) ; **JACQ, GERARD;** (*ATHIS DE L'ORNE, FR*)

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**10154**

**Serial No.:** **041538**  
**Series Code:** **09**  
**Filed:** **March 11, 1998**

**U.S. Current Class:** **442/331; 264/258; 442/327**  
**U.S. Class at Publication:** **442/331; 264/258; 442/327**  
**Intern'l Class:** **D04H 001/00; D04H 003/00; D04H 005/00; D04H 013/00**

**Foreign Application Data**

**Date**  
Mar 25, 1994

**Code**  
FR

**Application Number**  
9403518

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*Claims*

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1. Friction material designed for fitting to a device employing friction in a liquid medium, such as, in particular, a clutch or brake disc, notably for an automatic gear box or associated therewith, a synchronisation ring or cone for a manually-operated gearbox, characterised in that it consists of a mat of fibres impregnated with a resin of the thermosetting type, and in that the said fibres have a length of at least 12 mm.
2. Friction material according to claim 1, characterised in that the average length of the fibres is at most 120 mm.
3. Friction material according to claim 2, characterised in that the fibres are chosen from amongst the group of fibres of glass, wool, cotton, ceramic, polyacrylonitrile, preoxidized polyacrylonitrile and aramid.
4. Friction material according to claim 3, characterised in that fillers in powder form are incorporated into the mat.
5. Friction material according to claim 4, characterised in that the said fillers in powder form comprise all or some of the following elements or compounds: copper, rockwool, carbon (coke and/or reduced-powder carbon fibres, graphite), zirconium silicate, iron sulphide, alumina, rubber and diatoms.
6. Friction material according to claim 4 or 5, characterised in that fillers in the form of pulps are incorporated into the mat.
7. Friction material according to claim 6, characterised in that the said pulps comprise all or some of the pulps of glass, aramid, acrylic and phenolic fibres.
8. Friction material according to claim 1, characterised in that the resin of the thermosetting type includes a polar solvent, preferably aqueous.
9. Friction material according to claim 8, characterised in that the thermosetting resin is resol-based.
10. Friction material according to claim 8 or 9, characterised in that the thermosetting resin has latex added to it.
11. Friction material according to claim 1, characterised in that the thermosetting resin has fillers in powder form added to it which comprise all or some of the following elements: copper, rockwool, carbon (coke and/or reduced-powder carbon fibres, graphite), zirconium silicate, iron sulphide, alumina, rubber and diatoms.
12. Method of producing a friction material according to claim 1, characterised by the following steps: a) a mixture of fibres of the same nature or of different natures is produced in a mixer; b) the mixture is carded to form a card web; c) the card web is lapped; d) the lap thus formed is needled; e) the needled mat is impregnated with a thermosetting resin; f) the impregnated mat is dried.

13. Method according to claim 12, characterised in that between steps b) and c), fillers in powder form which comprise all or some of the following elements: copper, rockwool, carbon (coke and/or reduced-powder carbon fibres, graphite), zirconium silicate, iron sulphide, alumina, rubber and diatoms, are sprinkled on the card web.

14. Method according to claim 12 or 13, characterised in that, before step e), the thermosetting resin has added to it fillers in powder form which comprise all or some of the following elements: copper, rockwool, carbon (coke and/or reduced-powder carbon fibres, graphite), zirconium silicate, iron sulphide, alumina, rubber and diatoms.

15. Method according to claim 12, characterised in that step e) is preceded by an operation of impregnation of the needled mat by means of a dilution or dispersion in a liquid of fillers in powder form which comprise all or some of the following elements: copper, rockwool, carbon (coke and/or reduced-powder carbon fibres, graphite), zirconium silicate, iron sulphide, alumina, rubber and diatoms.

16. Method according to claim 12, characterised in that the carding is effected by means of a wool-type card.

17. Method according to claim 12, characterised in that the needling operation is preceded by a preliminary needling operation.

18. Method according to claim 12, characterised in that the resin impregnation is effected by soaking in a tank containing the resin in solution or dispersed in water.

19. Method according to claim 12, characterised in that drying is preceded by a squeezing or hydroextraction operation.

20. Method according to claim 12, characterised in that, after or during drying, the mat is wound up.

21. Method of producing a friction material according to claim 1, characterised by the following steps: a) a mixture of fibres of the same nature or of different natures is produced in a mixer; b) the mixture is carded to form a card web; c) fillers in powder form which comprise all or some of the following elements: copper, rockwool, carbon (coke and/or reduced-powder carbon fibres, graphite), zirconium silicate, iron sulphide, alumina, rubber and diatoms, and a resin in powder form, are sprinkled on the card web; d) the mat is pressed while being brought to a suitable temperature to ensure the flow of the resin.

22. Method according to claim 12 or 21, characterised in that: h) a ring, or as a variant a plurality of sectors forming a ring, is cut out from the mat.

23. Method of producing a device coated with a friction material obtained by means of the method according to claim 22, characterised by the following steps: i) the ring or plurality of sectors forming a ring is placed at the bottom of a mould; j) a metal support is placed in the mould on the ring or on the plurality of sectors forming a ring; k) where appropriate, a second ring or a plurality of sectors forming a ring is placed on the metal support, opposite the said ring or the said plurality of sectors forming a ring; l) the mould is closed, shims being disposed so as to control and limit the movement of a piston closing the mould; m) heating under pressure is effected in the mould, thereby also ensuring the adhesion of the said ring, and where applicable of the said second ring, to the metal support; n) the mould is opened and the device covered with the friction material is cooled.

24. Method of producing a device covered with a friction material according to claim 23, characterised

in that the shims limiting the movement of the piston are sized so that the porosity of the friction material is between 20% and 70%.

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*Description*

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[0001] The object of the present invention is a friction material designed for fitting to a device using friction in a liquid medium, and the method of producing such a friction material and the device to which it is fitted.

[0002] More particularly, such a friction material takes the form of a flat ring or a truncated cone and the device to which it is fitted is a clutch or brake disc, notably for an automatic gear box or associated therewith, operating in oil, or a synchronisation ring or cone for a manually-operated gearbox also operating in oil, such a device being installed in a vehicle.

[0003] The friction materials used up to now for the aforementioned applications are of three types: materials of the paper type, sintered materials and graphite-containing moulded materials.

[0004] The materials of the paper type consist essentially of cellulose fibres impregnated with resin.

[0005] They are obtained by a wet method using a normal paper-making process, that is to say by dispersing cellulose fibres in an aqueous solution containing a resin, then spinning and drying.

[0006] Such a method necessarily involves using short fibres, with an average length below one millimeter.

[0007] Materials of this type have the drawback of degrading very rapidly as soon as their temperature reaches 150.degree. C., which is the case when the device that is equipped with the friction material must, within a small space, transmit or absorb high torques at speeds which, in practice, are growing ever higher.

[0008] This situation now arises by virtue of, on the one hand, the increasing power of thermal engines and, on the other hand, the reduction in the size of the devices for transmitting engine torque, which make it necessary to increase the gripping pressure of the friction devices.

[0009] Sintered materials do not exhibit this drawback but, unlike materials of the paper type, the coefficients of friction obtained are low.

[0010] Moreover, these materials generate damaging vibrations and noises.

[0011] Materials of the graphite-containing moulded type have a relatively high cost price and do not permit stable transmission of a torque.

[0012] The aim of the invention is to overcome the aforementioned drawbacks by proposing a friction material for a liquid medium which has in particular a high, stable coefficient of friction, a high resistance to heating at high working pressures, and good resistance to wear.

[0013] A friction material for a liquid medium, according to the invention, is characterised in that it consists of a mat of fibres impregnated with a thermosetting resin, and in that the said fibres have a length of at least 12 mm.

[0014] According to other characteristics taken separately or in combination:

[0015] the average length of the fibres is at most 120 mm;

[0016] the fibres are chosen from amongst the group of fibres of glass, wool, cotton, ceramic, polyacrylonitrile, preoxidized polyacrylonitrile and aramid;

[0017] fillers in powder form are incorporated into the mat, comprising all or some of the following elements or compounds: copper, rockwool, carbon (coke and/or reduced-powder carbon fibres, graphite), zirconium silicate, iron sulphide, alumina, rubber and diatoms;

[0018] fillers in the form of pulps are incorporated into the mat, comprising all or some of the following compounds: pulps of glass, aramid, acrylic and phenolic fibres;

[0019] the resin of the thermosetting type includes a polar solvent, preferably aqueous;

[0020] the thermosetting resin has latex and/or fillers in powder form added to it which comprise all or some of the following elements or compounds: copper, rockwool, carbon (coke and/or reduced-powder carbon fibres, graphite), zirconium silicate, iron sulphide, alumina, rubber and diatoms.

[0021] The method of producing the friction material according to the invention is characterised by the following steps:

[0022] a) a mixture of fibres of the same nature or of different natures as defined above is produced in a mixer;

[0023] b) the mixture is carded to form a card web;

[0024] c) the card web is lapped;

[0025] d) the lap thus formed is needled;

[0026] e) the needled mat is impregnated with a thermosetting resin;

[0027] f) the impregnated mat is dried.

[0028] According to other characteristics taken independently or in combination:

[0029] between steps b) and c) above, fillers in powder form as defined above are sprinkled on the card web;

[0030] before step e) the thermosetting resin has fillers as defined above added to it.

[0031] step e) is preceded by an operation of impregnation of the needled mat by means of a dilution or dispersion in a liquid of the fillers as defined above.

[0032] the carding is effected by means of a wool-type card;

[0033] the needling operation is preceded by a preliminary needling operation;

[0034] the resin impregnation is effected by soaking in a tank containing the resin in solution or dispersed in water; drying is preceded by a squeezing or hydroextraction operation;

[0035] after or during drying, the mat is wound up.

[0036] As a variant, the method is characterised by the following operations;

[0037] a) a mixture of fibres of the same nature or of different natures, as defined above, is produced in a mixer;

[0038] b) the mixture is carded to form a card web;

[0039] c) fillers in powder form as defined above, and a resin in powder form, are sprinkled on the card web;

[0040] d) the mat is pressed while being brought to an appropriate temperature to ensure the flow of the resin.

[0041] In order to produce a device coated with friction material, the method according to the invention is as follows:

[0042] g) a ring, or as a variant a plurality of sectors forming a ring, is cut out from the mat produced as indicated above;

[0043] i) the ring or plurality of sectors forming a ring is placed in the bottom of a mould;

[0044] j) a metal support is placed in the mould on the ring or on the plurality of sectors forming a ring;

[0045] k) where appropriate, a second ring or a plurality of sectors forming a ring is placed on the metal support, opposite the said ring or the said plurality of sectors forming a ring;

[0046] l) the mould is closed, shims being disposed so as to control and limit the movement of a piston closing the mould;

[0047] m) heating under pressure is effected in the mould, thereby also ensuring the adhesion of the said ring, and where applicable of the said second ring, to the metal support;

[0048] n) the mould is opened and the device covered with the friction material is cooled.

[0049] As a variant, step g) is replaced by a step h) identical thereto, but conducted between steps d) and e) above.

[0050] According to other characteristics of the invention, taken independently or in combination:

[0051] the mould and piston have a flat bottom;

[0052] the bottom of the mould is grooved;

[0053] the mould and the piston are in the shape of a truncated cone;

[0054] the shims limiting the movement of the piston are sized so that the porosity of the friction

material is between 20% and 70%;

[0055] the heating temperature is between 130.degree. C. and 220.degree. C.

[0056] Other characteristics and advantages of the product and of the method will appear from a reading of the description that follows, of example embodiments and implementations of the invention, in relation to the accompanying drawings which depict:

[0057] in FIG. 1, the functional diagram of a first part of the installation designed for the implementation of the method according to the invention;

[0058] in FIG. 2, the functional diagram of a second part of this installation;

[0059] in FIG. 3, a diagram illustrating the cutting out of friction rings and sectors;

[0060] in FIG. 4, a series of graphs summarizing the results of comparative tests.

[0061] Four fibre mats (examples A, B, C, D) are produced from the following compositions by weight of fibres:

1 FIBERS EXAMPLES A B C D GLASS - Parts 20 -- 20 -- COTTON - Parts -- 30 -- -- CERAMIC -  
Parts 10 10 10 -- PAN (polyacrylonitrile or - Parts 10 -- 10 20 preoxidized)

[0062] The average length of the fibres used is as follows:

[0063] glass fibres: 50 mm;

[0064] cotton fibres: 18 mm;

[0065] ceramic fibres: 12 mm;

[0066] PAN fibres: 42 mm.

[0067] The above fibres or mixtures of fibres, produced in a mixer, are introduced into the hopper 1 (FIG. 1) of a feed device 2 for a wool-type card 3 which has a feed chute 4.

[0068] Fillers in powder form are sprinkled at the discharge from the card 3, on the card web formed, by means of a sprinkling device 5 (examples C and D).

[0069] The fillers in powder form have the following composition (composition by weight referred to the parts by weight of the above fibres):

2 Fillers IN POWDER FORM EXAMPLES A B C D COPPER -- -- -- 10 POWDERED ROCKWOOL -  
-- -- -- 10 GRAPHITE -- -- 10 -- COKE -- -- 10 --

[0070] The card web is then lapped by means of a lapper 6, and the lap thus formed undergoes a needling process in two phases: preliminary needling by a preliminary needler with rollers 7 and needling by a needler 8.

[0071] The mat of needled nonwoven material thus produced is, in the example depicted, wound on a roll 9 at the discharge from the first part of the installation.

[0072] The roll 9 is carried into a second part of the installation and is paid out for the remainder of the process of producing a friction material (FIG. 2).

[0073] As a variant (not shown), the second part of the installation follows immediately on from the first part and the needled nonwoven mat is not wound up.

[0074] The needled mat is fed into a cutting station 10 where rings 11 or sectors 12 as depicted in FIG. 3 or any other shape that the friction material is to take are cut out.

[0075] The part of the mat that is not cut out, or skeleton, is directed to a winder 13, for subsequent recycling.

[0076] The cut-out shapes 11 or 12 are conveyed into an impregnating bath 14 containing one or more resins of the thermosetting type in solution or dispersed in water.

[0077] The impregnating bath is of the following composition by weight, expressed in parts, in a manner consistent with the proportions indicated previously for fibres and fillers.

3 IMPREGNATING BATH EXAMPLES A B C D WATER-BASED RESIN 60 60 -- -- RESOL-BASED RESIN -- -- 40 60

[0078] In general, the following types of resin can be used:

[0079] phenolic plastic resins (resol or novolak);

[0080] aminoaldehyde resins (urea formaldehyde, melamine formaldehyde or combinations thereof);

[0081] epoxy (epoxide) resins;

[0082] polyimide resins.

[0083] At the end of impregnation, squeezing takes place, firstly in the bath (conveyor 16) and outside the bath (rollers 17).

[0084] As a variant, not shown, the cut-out shapes 11, 12 undergo, after soaking in the impregnating bath, a hydroextraction operation.

[0085] The cut-out shapes 11, 12 are then introduced into an infrared drying tunnel 18, and then packaged.

[0086] As a variant, the operation of cutting out the shapes is carried out after impregnation, squeezing and/or hydroextraction and drying.

[0087] In the latter case, the impregnated mat can be wound up in order to be transported to a cutting station as shown in FIG. 3.

[0088] Each cut-out shape, a ring or plurality of sectors forming a ring, is placed in a mould which has, depending on the equipment for which the friction material is intended, a bottom which is flat or in the form of a truncated cone or any other shape, grooved or otherwise.



[0089] A metal support is placed in the mould on the ring or plurality of sectors.

[0090] Where appropriate, a second ring is placed on the metal support, opposite the said ring or the said plurality of sectors forming a ring.

[0091] A metal support is placed in the mould on the ring or plurality of sectors forming a ring.

[0092] Where appropriate, a second ring or a plurality of sectors forming a ring is placed on the metal support, opposite the said ring or the said plurality of sectors forming a ring.

[0093] The mould is closed, shims being disposed so as to control and limit the movement of a piston closing the mould.

[0094] Heating under pressure is effected in the mould, which moreover ensures the adhesion of the said ring, and where applicable of the said second ring, to the metal support.

[0095] The mould is opened and the device coated with the friction material is cooled.

[0096] Advantageously, the shims limiting the movement of the piston are sized so that the porosity of the friction material is between 20% and 70% and the heating temperature is between 130.degree. C. and 220.degree. C.

[0097] In order to effect comparative tests with a known friction material of the paper type, two samples of friction material (clutch disc) are produced with the following composition by weight:

[0098] cellulose fibres: 30% (length: 2 to 20 mm);

[0099] phenolic resin: 31%

[0100] diatoms: 23%

[0101] aramid fibres: 10% (length: 6 to 20 mm)

[0102] quartz: 5%

[0103] sodium sulphate: 1%

[0104] Four series of three clutch friction discs produced in accordance with the invention from the compositions of the above examples A, B, C and D and two series of three clutch friction discs of the paper type having the above compositions underwent endurance tests under the conditions indicated hereinafter.

[0105] Three discs from the same series, corresponding to the same embodiment, are placed in a testing machine of the type defined by the standard SAE II (US standard).

[0106] The test is effected in an oil bath brought to 114.degree. C. A circulation of oil is also provided with a flow rate of between 2 and 3 liters per minute.

[0107] The test includes three series of cycles.

[0108] Each cycle consists of braking, until it stops, a centrifugal mass previously launched at a rotation

speed of 3600 revolutions per minute.

[0109] After each cycle the centrifugal mass is relaunched at the speed indicated above.

[0110] A 30 second time interval is provided between each cycle start.

[0111] The first series comprises 50 cycles where the unit-area pressure of the gripping of the discs is 0.5 Mpa, the inertia being 0.213 m.sup.2.kg.

[0112] The second series comprises 2400 cycles where the unit-area pressure of the gripping of the discs is 1.5 Mpa, the inertia being 0.501 m.sup.2.kg.

[0113] The third series is identical to the first.

[0114] The graphs in FIG. 4 represent the evolution of the dynamic friction coefficient of each of the six samples during the endurance cycles defined previously.

[0115] It will be observed that between 500 and 800 cycles, a paper lining is destroyed while the friction material according to the invention remains intact after 2500 cycles (end of tests).

[0116] Furthermore, a remarkable stability will be observed in the coefficient of friction of the material according to the invention during the cycles, at a level very close to that of a paper-type material.

[0117] Variant embodiments can be used.

[0118] In particular, fillers in the form of pulps can be incorporated into the mat, notably pulps chosen from amongst the group of pulps of glass, aramid, acrylic and phenolic fibres.

[0119] It is, moreover, entirely possible to incorporate the fillers into the liquid resin instead of, or in addition to, sprinkling them onto the mat.

[0120] The fillers can also be diluted or dispersed in a suitable liquid constituting a first impregnating bath for the mat, a second impregnation then being provided so as to ensure the addition of resin.

[0121] Furthermore, it is possible to use a solid resin, in the form of a powder, which is sprinkled onto the mat at the same time as the fillers. This mat is then pressed to the correct thickness at 60.degree. C. for 2 secs; in this variant, there is no needling or impregnation.

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